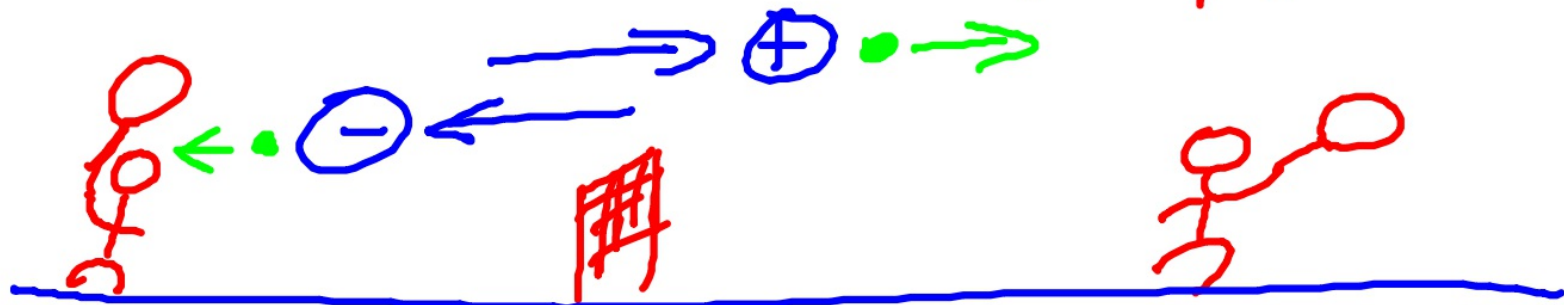


Serena
Williams

VS

ANNA
KOURNIKOVA



- a) Tennis Ball is .20 kg.
Serena hits the Ball to ANNA with
a velocity of 70 m/s
What is the momentum of the ball?
- | | |
|-----------------------|--------------------------|
| $m = .2 \text{ kg}$ | $P = mv$ |
| $v = +70 \text{ m/s}$ | $= (.2)(70 \text{ m/s})$ |
| $P = ?$ | $P = 14 \text{ kg m/s}$ |

b) ANNA hits it BACK.
the velocity now is 60 m/s .
What is the p of the Ball?

$$m = .2 \text{ kg}$$
$$v = -60 \text{ m/s}$$
$$p = ?$$

$$p = mv$$
$$= (.2)(-60 \text{ m/s})$$
$$= -12 \text{ kg m/s}$$

c) What impulse did Anna put on
the ball? $\Delta v = v_f - v_i$

$$\Delta p = ?$$

$$m = .2 \text{ kg}$$
$$\Delta v = ?$$

$$v_i = +70 \text{ m/s}$$
$$v_f = -60 \text{ m/s}$$

$$\Delta v = (-60) - (70) = -130 \text{ m/s}$$
$$\Delta p = m \Delta v$$
$$= (.2 \text{ kg})(-130 \text{ m/s})$$
$$= -26 \text{ kg m/s}$$

$\Delta P = \text{change in } P$

$$\Delta P = P_f - P_i$$
$$-12 - (-14)$$

$$\boxed{\Delta P = -26 \text{ kg m/s}}$$

↑ going left

d) if ANNA APPLIED 40 N of FORCE to the ball. How much CONTACT time?

IF Serena hits the ball
back with a force of 100N
and a contact time of .5 sec
how fast is the ball returned?

$$F = 100\text{N}$$

$$\Delta t = .5\text{sec}$$

$$m = .2\text{kg}$$

$$v_i = -60\text{m/s}$$

$$v_f = ?$$

#1 FIND Δp

$$\Delta p = F \Delta t$$

$$\Delta p = (100\text{N})(.5\text{sec})$$

$$\Delta p = 50\text{kgm/s}$$

#2 FIND Δv

(ON NEXT PAGE)

#2 (cont)
 $\Delta v = ?$

$$m = .2 \text{ kg}$$

$$\Delta p = 50 \text{ kg m/s}$$

$$\Delta p = m \Delta v$$

$$\frac{50 \text{ kg m/s}}{.2 \text{ kg}} = \frac{.2 \text{ kg} (\Delta v)}{.2 \text{ kg}}$$

$$\Delta v = 250 \text{ m/s}$$

#3 FIND v_f

$$v_i = -60 \text{ m/s}$$

$$\Delta v = 250 \text{ m/s}$$

$$v_f = ?$$

$$\Delta v = v_f - v_i$$

$$250 \text{ m/s} = v_f + 60 \text{ m/s}$$
$$\begin{array}{r} 250 \text{ m/s} \\ -60 \text{ m/s} \\ \hline \end{array} = v_f - (-60 \text{ m/s})$$
$$\begin{array}{r} 250 \text{ m/s} \\ -60 \text{ m/s} \\ \hline \end{array}$$

$$v_f = 190 \text{ m/s}$$